User Group Deployment

Puget Sound Help Me (PuSHMe) Operational Test
Task 3 Technical Memorandum

Prepared for the

Federal Highway Administration
Washington State Department of Transportation
Washington State Patrol

Prepared by

David Evans and Associates, Inc.

in association with

AT&T Wireless Services
IBI Group
Motorola Space and Technology Systems Group
University of Washington Laboratory of Usability Testing and Evaluation (LUTE)
University of Washington Technical Communications Department
XYPOINT Corporation

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1 .0 INTRODUCTION

Safety is a major goal of the National Intelligent Transportation System (ITS) Program. To promote safety, the Federal Highway Administration (FHWA) funded several field operational tests to evaluate technologies designed to decrease transportation related risk. Mayday services were among these technologies. Mayday services allow motorists to report incidents to service centers which, in turn, alert a service provider who dispatches aid to the scene. Mayday services meet the national ITS goal of improving safety by "improving [emergency medical] and roadway service response, reducing the number of fatalities and the severity of injuries resulting from a collision, and reducing the number of pedestrian and vehicle collisions secondary to an incident."[1]

These technologies will be introduced into a well established E-911 / Emergency Service arena. This arena has its own protocols, technologies, regulations, liability, and risks. New technologies that enter into this arena must adhere to or complement the existing structure in order to be effective. The User Deployment phase of the Puget Sound Help Me (PuSHMe) project conducted a series of tests to determine if two prototype Mayday technologies would provide such information and be able to integrate into the existing E-91 1 system. This report documents the User Deployment Phase of the Puget Sound Help Me (PuSHMe) Field Operational Test in Seattle, Washington. This phase of the PuSHMe evaluation directly tested the functioning and reliability of the PuSHMe technologies.

1.1 PROJECT ORIGIN

The PuSHMe Project originated in 1993 when the FHWA released a request for participation in the Intelligent Transportation Systems (ITS) Field Operational Test. This request sought offers from the public and private sectors to form partnerships to conduct operational tests in support of the National ITS Program.

Operational tests serve as a transition between research and development (R&D) and full scale deployment of ITS technologies. An operational test integrates existing technology, R&D products, institutional, and perhaps regulatory arrangements to test new technological, institutional, or financial elements in a controlled testing environment. The tests permit an evaluation of how well newly developed ITS technologies work under actual operating conditions and assess the benefits and public support for the product or system.

The request called for the creation of cooperative ventures with a variety of public and private partners including State and local governments, private companies, and universities. The request indicated a need to advance the National ITS Program in the area of emergency notification and personal security (driver and personal security). Evaluation was deemed to be an integral part of each operational test and critical to the success of the National ITS Program.

In response to this request, the Advanced Technology Branch of the Washington State Department of Transportation (WSDOT), David Evans and Associates, Inc. (DEA), the IBI Group, and the Washington State Patrol formed a partnership to conduct an

[1] National ITS Program Plan, USDOT, Fuller, Robertson, eds. March 1995.

operational test of an Emergency Notification and Personal Security system. Negotiations with several technology providers resulted in the participation of XYPOINT and Motorola. The University of Washington was asked to provide an independent evaluation.

1.2 PROJECT PARTNERS AND ROLES

The final PuSHMe project team consisted of a consortium of three public agencies, five private corporations and an academic institution. The FHWA, the WSDOT, and the Washington State Patrol sponsored the project, provided support and approved the various work elements. The private sector contributed approximately 18 percent of the budget. DEA was the prime contractor and had overall management responsibility. The IBI Group assisted DEA with project implementation and integration. In addition, IBI Group led selected technical activities primarily associated with system integration and interfaces between the two technology providers and the University of Washington. Motorola and XYPOINT were the technology providers and provided emergency notification devices and customer response center systems. RSPI provided response center experience and expertise.

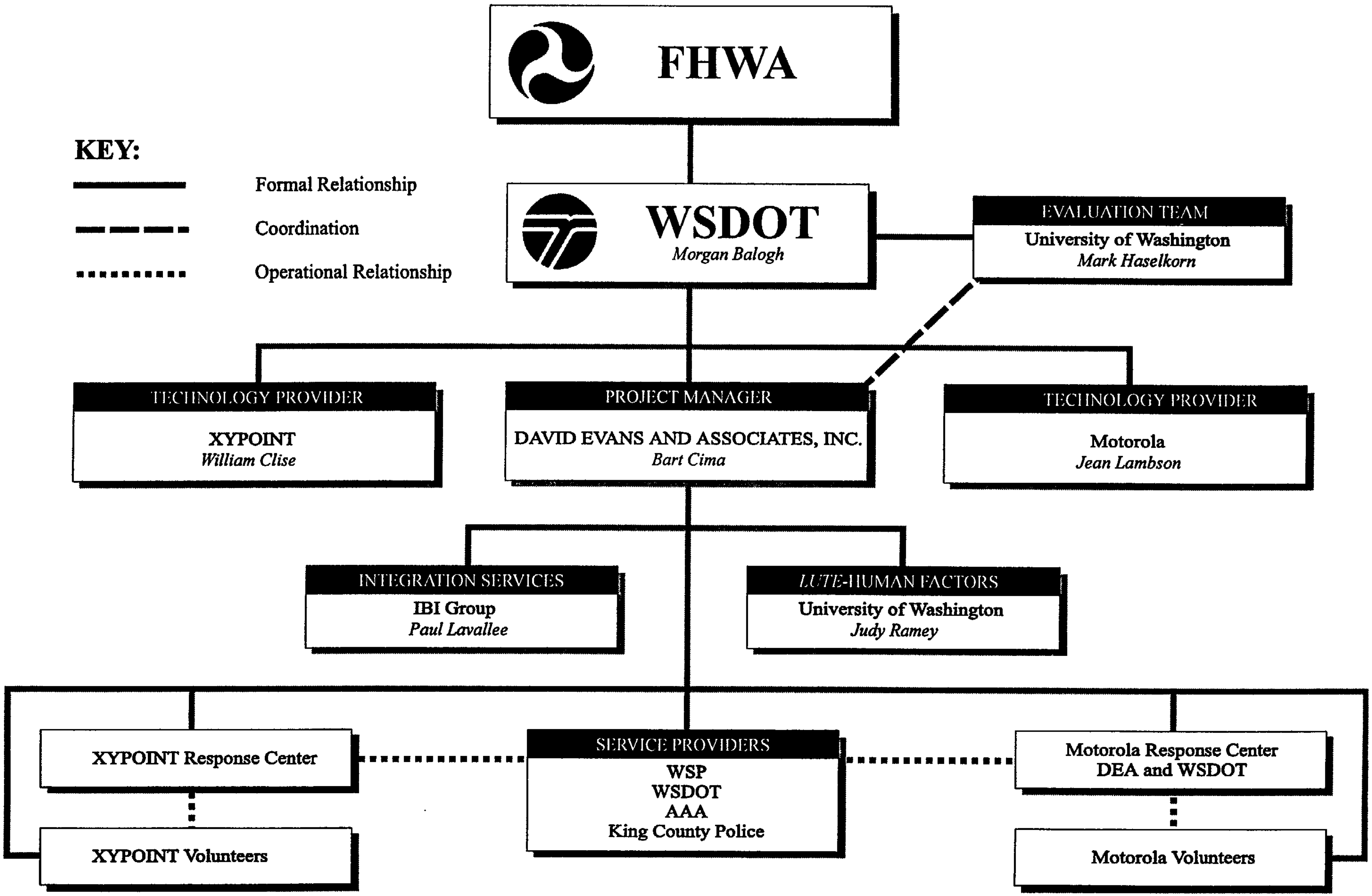
Two groups at the University of Washington participated in the PuSHMe project. The primary role of the Laboratory of Usability Testing and Evaluation (LUTE) which is part of the University of Washington's Technical Communications Department, was to determine the requirements of the response center personnel. This effort included determining the requirements necessary for response centers and technology providers to support a Mayday service.

AT&T Wireless Services was not a signatory of the PuSHMe memorandum of understanding. However, they donated cellular air time, installed the Motorola emergency notification devices and provided access to the Puget Sound region's Cellular Digital Packet Data (CDPD) network.

The Evaluation Team consisted of select faculty from the Technical Communication, Electrical Engineering and Management Departments at the University of Washington. This independent evaluation team determined with the project team the PuSHMe test objectives, prepared the projects evaluation plan, assisted DEA in the development of the field testing plan, evaluated the data collected as part of the User Group Deployment, and will prepare an evaluation report.

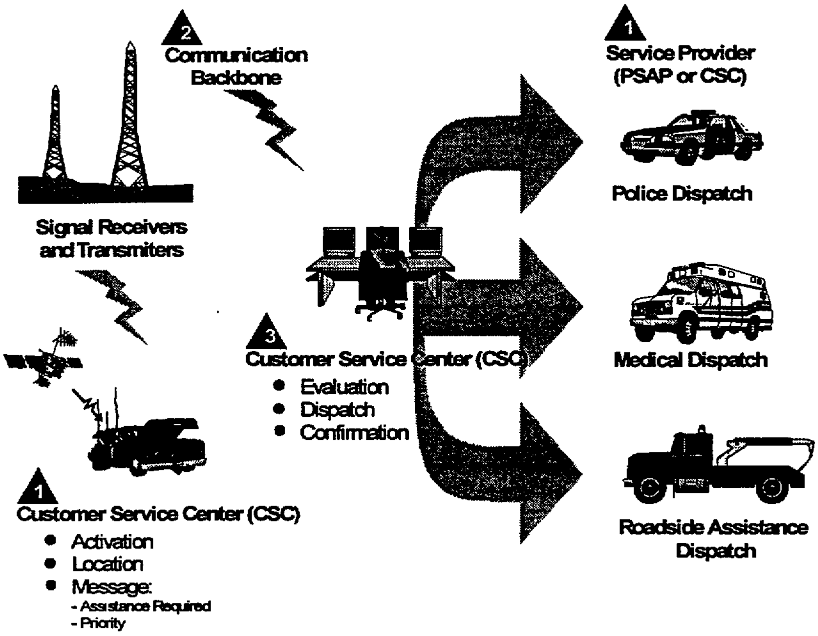
Figure 1 .1 shows the organizational chart. This chart also describes the relationships between the members of the project team. During the project, the project team participated in bi-weekly conference calls to discuss relevant issues.

Figure 1.1: Organizational Chart



1.3 MAYDAY OPERATIONAL OVERVIEW AND CONCEPT

Figure 1.2:
PuSHMe System Concept



As shown in **Figure 1.2**, a typical Mayday call involves a customer needing assistance, pushing a button on their device, their problem and location being transmitted to a service center, the service center calling the appropriate service provider, and service being dispatched to the scene. The Mayday call would arrive with Global Positioning System (GPS) data that provides the exact location of the caller. The Mayday operator would be located in a Customer Service Center (CSC) that maintains a database of customer information (e.g. medical information, emergency contacts, etc.). The CSC, operated as a subscription service, allows quick access to customer information in an emergency. The service provider is a Public Safety Answering Point (PSAP), commonly known as a E-911 center, or another CSC that dispatches aid or communicates medical advice.

Mayday systems can provide a wide range and delivery of services. While these systems have some of the characteristics of alarm, incident response or emergency services, they go beyond these. Unlike home alarm companies, the operators of a Mayday system will usually be contacted directly by a customer and not an automated alarm system. Unlike auto clubs or an ambulance service, the Mayday operator will not, in most cases, directly dispatch service. However, calls on a Mayday system may include automotive, personal injury, criminal, or traveler assistance calls. The types of calls a Mayday operator will need to respond to were more varied than most of these established private subscription services.

A PuSHMe system could offer benefits to both the customer and the PSAP community. The customer benefits from having a PuSHMe system by knowing that, when necessary, they can signal an alert with the push of a button and be assured that the Mayday service provider will know their exact location and provide a customized response. A PuSHMe service can offer several benefits to the PSAP community, including:

- better location data;
- personal medical histories;
- pertinent personal information; and

- duplicate call reduction.

This type of service, if delivered effectively, will provide better information in emergency situations to PSAPs while reducing customer stress in an emergency.

1.4 PUSHME TECHNOLOGIES OVERVIEW

The Puget Sound PuSHMe (PuSHMe) project evaluated two GPS-equipped Mayday prototype technologies: a Motorola system employing an analog cellular phone and a XYPOINT system utilizing a two-way pager operating on the Cellular Digital Packet Data (CDPD) protocol network. Each device has three main buttons that designate the type of emergency. This allows the CSC to prioritize and tailor their response based upon the users perception of their problem. The Motorola device uses Police, Automobile, Traveler's Assistance, and a hidden panic button. The XYPOINT device uses the following emergency buttons: Emergency, Medical, and Automobile. The XYPOINT device also has Yes and No keys to communicate with the CSC.

The basic functions of the two devices are similar. A user initiates an emergency call to a Central Service Center by pressing a button on the device. The CSC receives and processes the call and sends location, incident and subscriber information to the appropriate emergency service. In obtaining and refining information, the Motorola device has a cellular phone link that provides voice contact between the user and the CSC. The XYPOINT device has an l&character LCD display screen that the CSC can use to ask the user questions. The user responds using the device's "Yes" and "No" keys.

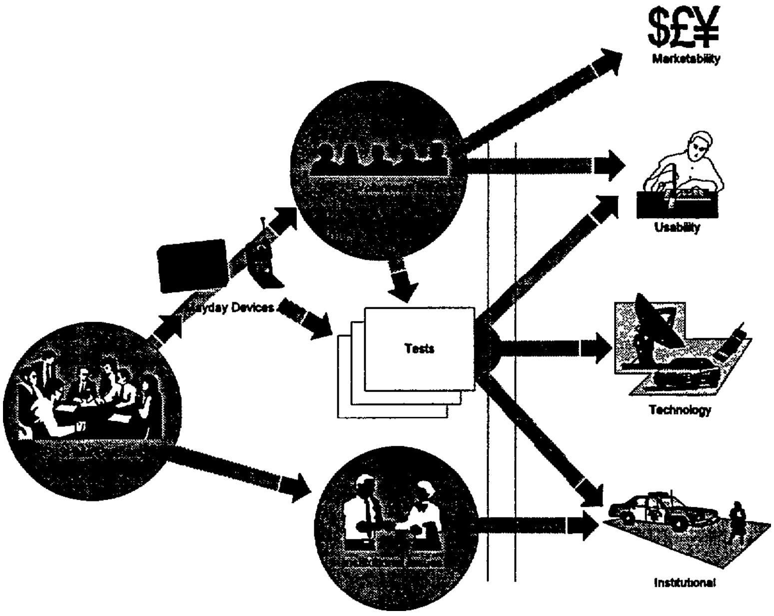
Both the Motorola and the XYPOINT systems use GPS technology to locate callers and map-based Geographic Information Systems (GIS) to display the location of callers. Since uncorrected GPS data is only accurate within 100 meters, the GPS data for both systems was differentially corrected. Differential correction improves positioning signal accuracy provided by the GPS satellites deployed by the United States Government. Differential correction provides accurate location information within three meters. GPS data is provided in latitudinal and longitudinal coordinates. GIS system takes the coordinates and ascribes them to points on a map. GIS is also capable of providing landmarks and routing information. Together, these systems allow the CSC operators to give real-world locations to service providers when reporting Mayday calls.

Both Mayday systems also provide customer databases that link data generated when a call is received to pre-entered customer information. This information can include automobile, medical, and other relevant personal information. In the event the user cannot communicate, these databases can provide important emergency information.

1.5 PUSHME FIELD OPERATIONAL TEST OVERVIEW

Figure 1.3

PuSHMe Test Structure



Responsibilities for PuSHMe were divided between the Partners and the Evaluation Team. The PuSHMe partners were responsible for creating the technologies and systems, designing tests and facilitating the data collection, conducting the tests of the devices, and providing the data to the Evaluation Team. The Evaluation Team was responsible for setting sample sizes, defining the evaluation tests, and processing and evaluating the data. The PuSHMe project included usability, marketability, institutional and technological evaluations. These four evaluation areas were designed to evaluate the systems' abilities to provide economical and useful services and information to users, operators and emergency service personnel. Evaluation tasks were carried out as set forth in the Detailed Evaluation *Plan*[2]. This plan defined the type of tests, testing goals, testing objectives, measures of effectiveness and data sources for the projects evaluation. The remainder of this section described the various components on the PuSHMe evaluation.

The usability evaluation determined how the participating users interacted with the devices. Data for this portion was collected by the PuSHMe Partner Laboratory for Usability Testing and Engineering and was used by the Evaluation Team for the usability section of the Final Evaluation Report. This portion addressed whether people understood the buttons, if they could use the system under duress and their general reactions on how the devices and system operated. This information was gathered through direct experience with the devices and interviews with users and questionnaires.

The marketability evaluation identified the demand, the market, and what public/private partnerships could best meet such a demand for an in-vehicle Mayday system. Data for this section was gathered directly by the Evaluation Team, evaluated and presented in the Final Evaluation Report. A series of hypothetical Mayday systems were created. Users were interviewed to determine what choices and options would provide them with the most value. The best possible public/private service provision scheme was then determined,

2 Haselkom, et al., Detailed Evaluation Plan, University of Washington, (November 17, 1995).

The Institutional evaluation had two main focuses. Institutional issues needed to be explored both in the operations of a mayday system and within the PuSHMe field operational test itself. The partners focused on issues surrounding mayday system operation, while the evaluation team focused on the institutional issues within the PuSHMe Project.

The PuSHMe partner's researched the institutional issues surrounding private centers. The *PuSHMe Institutional Issues Report*[3] was written by the PuSHMe Partners and described several of the major institutional issues and recommended strategies to address them. The bulk of these issues dealt with the legal challenges inherent in the operation of an emergency service (e.g. liability, privacy, etc.). The majority of the solutions to these were systemic and would require standards to be developed within the industry as it matured (e.g. levels of training, licensing, etc.).

The Evaluation Team investigated the internal institutional issues specific to the PuSHMe Project. The Evaluation Team interviewed the partners and described the internal interactions in the Final Evaluation Report. The Evaluation Team also used some of the information from the *PuSHMe Institutional Issues Report.*

The PuSHMe partners also investigated the issues surrounding the transfer of data, information and calls from the CSC to the PSAP. Protocols for information transfer, the use of particular technologies, changing PSAP jurisdictional boundaries, hand-off of liability, and roles of the PSAP and CSC operators were discussed by PuSHMe personnel, upstart private service providers and the PSAP community in a series of focus groups. These groups helped create base standards for calls based on the call type and caller disposition.

Finally, **the technological evaluation** tested the Mayday technologies provided by the technology partners. The technological evaluation consisted of three types of tests: the Partial Field Test, the Full Field Test, and the Specific Tests. These tests were conducted over a seven month period between November, 1995 and May, 1996 and included:

- **The Partial Field Operational Test.** About 200 volunteers used the devices on a daily basis and provided a measure of how quickly and reliably the system could accept, recognize, and prioritize a call.
- **The Specific Tests.** This battery of tests analyzed the specific functions of the devices. The Specific Tests included the dropped carrier, moving, topographic interference, location specific, and nation-wide tests.
- **The Full Field Operational Test.** Mayday calls were simulated and evaluated from start to finish, including the dispatch of emergency services.

These tests were carried out in the User Group Deployment Phase of the PuSHMe test. The remainder of this report describes these tests in detail.

1.6 REPORT STRUCTURE

This report describes the testing requirements, execution and data transfer of the user group deployment phase of the PuSHMe project. This report does not provide the

3 David Evans and Associates, PuSHMe Institutional Issues Report, (August, 1996).

statistical results of the PuSHMe tests, as those results are provided in the *Final Evaluation Report* by the University of Washington's Department of Technical Communications. This report is divided into sections which describe:

- **Section 2.0 - Evaluation Requirements:** the evaluation requirements for each test set by the Detailed Evaluation Plan;
- **Section 3.0 - Overview of the PuSHMe Tests:** descriptions of the PuSHMe tests with test dates, number of tests and goals for the tests;
- **Section 4.0 - Execution of the Partial Field Test:** the execution of the Partial Field Operational Test with test details, results and lessons learned;
- **Section 5.0 - Execution of the Specific Tests:** the execution of the Specific Tests with test details, results and lessons learned;
- **Section 6.0 - Execution of the Full Field Operational Test:** the execution of the Full Field Operational Test with test details, results and lessons learned;
- **Section 7.0 - Data Collection, Packaging and Distribution:** a description of data management in PuSHMe; and
- **Section 8.0 - Conclusions:** The top three lessons learned from the PuSHMe project.

2.0 EVALUATION REQUIREMENTS

PuSHMe's Detailed Evaluation Plan was completed in November, 1995. This plan detailed the various tests to be conducted during the PuSHMe evaluation and the measures of effectiveness used to evaluate them. The Detailed Evaluation Plan was a collaborative effort between the Partners and the Evaluation Team designed to provide a fair evaluation based on deliverable information.

The specific requirements for the evaluation were covered in Chapters 2 and 5 of the Task 2 Memorandum *Controlled Field Testing.* These requirements are also covered in the University of Washington's *Final Evaluation Report.*

The User Deployment Phase exercises addressed two main goals of the detailed evaluation plan:, Evaluate System Performance and Evaluate System Usability. The objectives, hypotheses, measures of effectiveness, and data sources used to meet these goals are described in **Tables 3.1 and 3.2.**

Table 3.1:
Goals Addressed in User Deployment

GOALS	OBJECTIVES	HYPOTHESES	MEASURES OF EFFECTIVENESS	DATA SOURCES
A. Evaluate System Performance	Determine whether the system performs as designed.	The system performs as designed within acceptable limits.	See Table 3.2	0 User Response Forms 0 Response Center Computers 0 CSC Operators 0 Simulated Service Provider Forms
	Determine whether the system performs to meet service requirements.	The system performance is sufficient to meet service requirements. The system is more effective than comparable alternatives.	Time and location equirements for emergency response. Comparison to performance of regular cellular phones.	0 Literature Review 0 Partner-provided Cellular Phone Comparison Data 0 User Response Forms 0 Response Center Computers 0 csc operators 0 Simulated Service Provider Forms
B. Evaluate System Usability	Evaluate whether users accept the system (e.g., how it works).	The system is easy to use.	User performance and assessment 0 Frequency of the correct button being pushed 0 Ease of using devices	0 Literature Review 0 Questionnaires 'O User Response Forms 10 Interviews (ii needed)
	Evaluate whether users like the system (e.g., what it does).	The system is desirable.	User perceptions of: 0 Response, 0 Reliability, 0 Safety, and 0 Security	

Table 3.2: Evaluation Requirements for User Group Deployment

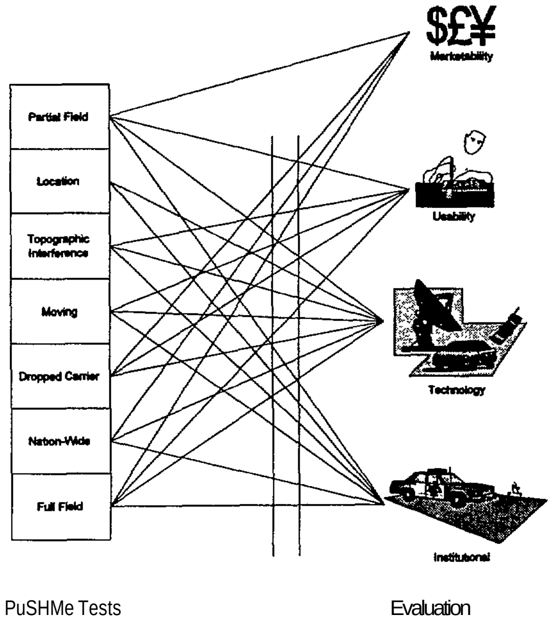
TESTS	INDEPENDENT VARIABLES		MOEs	DATA SOURCES THAT ADDRESS MOEs	# Trials Motorola	# Trials XYPOINT
I. Full Field Operational Test	Motorola (1 Cond.) 1. Time of Day - Peak Cellular 2. Environment - Suburban 3. Circumstance - Emergency	XYPOINT (1 Cond.) 1. Time of Day - Peak Cellular 2. Environment - Suburban 3. Circumstance - Medical 4. Response - Yes	1. Time Delays 2. Quality of Information Concerning Location of Incident 3. Call Connected with One Button Push a. Yes b. No 4. Call Disconnected During Test a. Yes b. No	1. User Response Form; CSC System Generated Data Packet; CSC Operator entered Information; Emergency Service Provider Response Form 2. Emergency Service Provider Response Form 3. User Response Form 4. User Response Form	100	100
II. Partial Field Operational Test	Motorola (18 Cond.) 1. Time of Day a. Pk. Cell. Hrs. b. Off-Pk. Cell. Hrs 2. Environment a. CBD b. Rural c. Suburban 3. Circumstance a. Emergency b. Rdside Assist. c. Traveler Assist.	XYPOINT (36 Cond.) 1. Time of Day a. Pk. Cell. Hrs. b. Off-Pk. Cell. Hrs 2. Environment a. CBD b. Rural c. Suburban 3. Circumstance a. Police b. Medical c. Auto 4. Response a. Yes b. No	1. Time Delays 2. Call Connected with One Button Push a. Yes b. No 3. Call Disconnected During Test a. Yes b. No	1. User Response Form; CSC System Generated Data Packet; CSC Operator entered Information 2. User Response Form 3. User Response Form	3,600	7,200
III. Specific Tests						
Specific Test 1 - Dropped Carrier Specific Test	Motorola (1 Cond.) 1. Time of Day - Peak Cellular 2. Environment - Suburban 3. Circumstance - Emergency	XYPOINT (1 Cond.) 1. Time of Day - Peak Cellular 2. Environment - Suburban 3. Circumstance - Medical 4. Response - Yes	1. Operator Recognizes Call Drop a. Yes - FD Entered by CSC b. No - FD Not Entered by CSC 2. Call Re-established at its Previous Rank a. Yes - AR Entered at CSC b. No - AN Entered at CSC	1. CSC Operator-entered Information 2. CSC Operator-entered Information	100	100
Specific Test 2 - Moving Test	Motorola (1 Cond.) 1. Time of Day - Peak Cellular 2. Environment - Suburban 3. Circumstance - Emergency		1. Vehicle Location Tracked Correctly for 15 Minutes	1. CSC "Breadcrumbs Trail" Map Compared to Pre-determined User Route Maps	100	N/A

Table 3.2: Evaluation Requirements for User Group Deployment (continued)

TESTS	INDEPENDENT VARIABLES	MOEs	DATA SOURCES THAT ADDRESS MOEs	# Trials Motorola	# Trials XYPOINT
Specific Test 3 - Topographic Interference Test	Motorola and XYPOINT (4 Cond. Each) 1. Barrier a. In Between Buildings (Urban Canyon) b. In Parking Garages c. In Forest d No Barriers 2. Time of Day - Peak Cellular 3. Circumstance - Emergency/Medical	1. Time Required for the GPS Location to be Received in the Vehicle 2. Time Required for User Location and Service Request to be Received at the CSC 3. The Call Connecting With One Button Push	1. CSC System Generated Data Packet 2. CSC System Generated Data Packet 3. User Response Form	200	200
Specific Test 4 - Location Specific Test	Motorola and XYPOINT (3 Cond. Each) 1. Time of Day - Peak Cellular 2. Environment a. CBD b. Rural c. Suburban	1. Location Accuracy (Lat./ Long.)	1. CSC System Generated Data Packet, User Response Form	100	100
Specific Test 5 - Nation-wide Test	Motorola (2 Cond.) 1. Time of Day - Peak Cellular 2. Type Environment - Constant 3. Location of Initiation (Seattle/Phoenix) 4. Circumstance - Emergency	1. The Call Connecting With One Button Push 2. Location Accuracy (Lat./ Long.) 3. Quality of Voice Communication	1. User Response Form 2. CSC System Generated Data Packet, 3. User Response Form	50	N/A

3.0 OVERVIEW OF THE PUSHME TESTS

Figure 3-1: PuSHMe Evaluation Flow



This section describes the testing process of the Puget Sound Help Me (PuSHMe) in-vehicle Mayday technologies. The technologies were tested between November, 1995 and May, 1996 in Washington State's Puget Sound Region. The technologies were tested for reliability, usability, accuracy and performance. Figure 3.1 illustrates the input from each test into each evaluation effort. The technologies were put through the following battery of tests.

Partial Field Operational Test

The Partial Field Operational Test collected information regarding the reliability and usability of the XYPOINT and Motorola systems. Testing occurred daily over a six month period. These tests had about 200 volunteers use their device once per day, except weekends and holidays. Data from these tests were used in all four evaluations.

Location Specific

The Location Specific test evaluated the accuracy of the GPS technologies. The tests occurred from April 11-17, 1996 at locations throughout the region that were previously dual-verified with both GPS and standard surveying techniques. Each device was tested 100 times. Data from this test were used in the technological and institutional evaluations.

Topographic Interference

The Topographic Interference test determined the accuracy of the systems in the presence of various topographic challenges. The tests were conducted between January 22-25, 1996. Each device was tested in four conditions: parking structures, urban canyons, forests and open terrain. Fifty tests per device per condition were conducted for a total of 200 tests per device. Data from this test were used in the usability, technology and institutional evaluations.

Moving

The moving test determined the systems' abilities to track a moving vehicle. The tests for the Motorola system were conducted between February 5-8, 1996. The

XYPOINT tests were conducted on February 14, 1996. One hundred tests were conducted per device. Data from this test were used in the usability, technology and institutional evaluations.

Dropped Carrier (Motorola Only)

The dropped carrier test determined the systems' ability to re-engage an interrupted call. The Motorola devices were tested between January 31 and February 2, 1996. The devices were run through 100 tests. No tests of this type were conducted for the XYPOINT system. Data from this test were used in the usability, technology and marketability evaluations.

Nation-Wide Testing (Motorola Only)

The Nation-Wide Tests determined the ability of a CSC system to handle a call in another part of the country. This test was conducted on May 21, 1996, from 1:00 p.m. to 3:00 p.m. Fifty tests were conducted for the Motorola system only. Data from this test were used in the marketability, technology and institutional evaluations.

Full Field Testing

The Full-Field Test determined the viability of the system to function through all stages of an emergency call and provide useful information to response providers. Useful information would provide correct location and personal information quickly and efficiently to speed call response time. This test also tested protocols for CSC to PSAP communications. This test was conducted May 22-23, 1996. Fifty tests were conducted for the Motorola System only. Data from the Full Field tests were used in all four evaluations.

This document describes the formulation, execution and results of these tests. Results and lessons learned are presented in this report and are from the perspective of conducting and managing the tests only. Actual statistical findings from the data will be presented by the University of Washington Department of Technical Communications *PuSHMe Evaluation Report.*

4.0 EXECUTION OF THE PARTIAL FIELD TEST

The first PuSHMe test was the partial field operational test. The partial field operational test provided data regarding the usability and reliability of the PuSHMe devices and the information provided by these systems. About 200 volunteers activated their XYPOINT and Motorola devices once per day, every working day for six months. Volunteers were recruited from regional businesses, government agencies and Vanpools. The aim of volunteer recruitment was to get participation by regular automotive commuters and not a representative demographic sample of Puget Sound residents.

The following protocols were followed for the Partial Field Operational Test.

Users were given forms that provided them with a random Mayday scenario. These scenarios described a situation that would require the user to place a Mayday call. These scenarios are shown in **Table 4.1.**

Table 4.1 Partial Field Operational Test Scenarios

Scenarios
Your vehicle has been vandalized.
Your radio has been stolen.
You have been hijacked.
Individual demands your money at gun point.
Two people beat you with baseball bats,
A car ran into your vehicle. Your right arm is broken.
You saw a cyclist get hit by a car.
You've smashed your fingers in the vehicle door.
Your passenger suffered a heart attack.
You have broken your leg.
You have two flat tires.
Your engine has overheated.
You have a flat tire and no spare.
Your vehicle refuses to start,
You see a stalled Chevrolet with its hood up at the side of the road.
You are out of gas.

The users would press the button on their device they felt was most appropriate during the users' evening commute. For the Motorola system the user could choose between Emergency, Roadside Assistance, and Traveler Assistance. For the XYPOINT System, the user could choose between 9-1-1, Medical or Roadside Assistance. Initially, this test was designed with a mandatory location type and a time to call. Poor response in the first stages of testing indicated that predetermining a call time for volunteers resulted in a high instance of missed tests. The test was then redesigned to allow the user to push the button at any time and in any place and then record the time and location type of the button push.

Each log sheet was pre-coded and individual to the user. The forms had a series of pre-completed fields that provided the following information:

- Volunteer Name;

- Cellular or Telephone Number (if Motorola);
- Date test should be completed;
- Unit Number; and
- Type of Emergency.

Upon calling, the user would complete the log sheet which collected the following data:

- Time Call Initiated;
- Time of Receipt;
- Type of Location (Rural, Urban or Suburban)
- Weather (Cloudy, Snow, Clear)
- Confirmation by CSC (Yes / No)
- Did Caller Lose Contact with CSC? (Yes / No)
- If Contact was Lost, Did System Automatically Reestablish? (Yes / No)
- Button Pushed; and
- Comments.

Table 4.2 describes the actions of the Motorola User during the Partial Field Operational Test, while **Table 4.3** describes the actions of the Motorola CSC Operator.

Table 4.2: Motorola User Actions – Partial Field Operational Test

1	Press appropriate button;
2	Mark down time of call initiation; button pressed, weather, location, and location type.
3	Wait for CSC operator to answer call with "PuSHMe, what are you reporting?".
4	With answer circle Y in Connection and note time of connection.
4a	If no answer within three redials, circle N in Connection and hit the END key.
5	State the nature of the emergency.
6	CSC Operator will reply, "Thank You".
7	Say. "You're welcome."
8	Terminate the call by pressing the END key and hanging up the handset.

Table 4.3: Motorola CSC Actions – Partial Field Operational Test

1	When call appears answer with, "PuSHMe, what are you reporting?"
2a	If the caller identifies the type of emergency, say, "Thank You". Enter VF in call-notes.
2b	If the call is incomplete or the caller is unable to verify the call, Enter XF in call-notes
3	When the user says. "You're welcome." Hit END CALL.

Table 4.4 describes the actions of the XYPOINT User during the Partial Field Test, while **Table** 4.5 describes the actions of the XYPOINT CSC Operator.

Table 4.4: XYPOINT User Actions – Partial Field Operational Test

1	**Plug device in and wait for screen to say "PuSHMe".**
2	Press appropriate button.
3	Mark down time button pressed.
4	System will beep while connecting.
5	System will connect and say "Confirm <Button>"
6	Hit 'Yes" Key if Confirm message is the button you pressed.
7	Circle "Yes" or "No" on the log sheet as appropriate
8	Screen will say "Disconnecting."
9	Screen will say, "PuSHMe."
10	Unplug unit

Table 4.5: XYPOINT CSC Actions – Partial Field Operational Test

1.	Incident icon appears on screen
2.	Select Accept to accept the incident or Reject to send to another operator.
3.	**Wait for Yes or No response**
4.	**After Response select Terminate.**

Note: The XYPOINT system generated the same information as the Motorola system, but the XYPOINT *system automatically recorded this information.*

While the actual data from the Partial Field Operational Test will be presented in the *Final Detailed Evaluation Report* by the University of Washington, there are some other lessons to be learned in the construction and execution of field tests.

Careful volunteer management will increase the effectiveness of the tests and usefulness of the data obtained. The PuSHMe Partial Field Operational test utilized almost 200 volunteers over its course. Volunteer participation was somewhat inconsistent. When interviewed, volunteers commented that their participation would have been enhanced if they understood more of their role in the test.

The Partial Field Operational Test was conducted in such a way that the volunteers rarely came into contact with the PuSHMe staff. They had little feedback regarding whether they were doing a good job or if they were contributing to the project.

While this did not significantly impair the collection of PuSHMe test data, it did generate less data than was originally anticipated. Future tests should include methods to make the volunteers feel like active participants. This can be achieved by contacting them directly, having a newsletter, or providing them with a phone-in comment line. In addition, the single use of the device (Mayday) and the fact that the system did not offer them an actual operating service during the testing period made the devices useless for the volunteers.

The second area of lessons learned concerns the selection and training of CSC personnel. Preliminary PuSHMe test results indicate that the codes entered and actions taken by the PuSHMe CSC personnel were inconsistent. In a fully-functional commercial CSC these events would be highly standardized and well-practiced. Since PuSHMe was operating just as the Mayday industry was being invented and implemented, standards for operations and training had yet to be developed. A fully trained staff will be a requirement for any Mayday service. More details are provided in the Full Field Operational Test lessons learned.

VOLUNTEER EQUIPMENT MAINTENANCE

For the Partial Field Test, equipment also needed to be replaced when broken or non-functioning. Project staff members kept track of all units in the field and replaced them when necessary. At the end of the testing, about 50% of all units of both technologies needed replacement. Most replacements took place in less than three days and did not have any significant impact on the PuSHMe testing. This was not seen as an indication of the reliability of the technologies, as both systems being tested were prototypes.

5.0 EXECUTION OF THE SPECIFIC TESTS

This section describes the execution of the five specific tests. These tests provided information on specific individual functions of a Mayday system. These functions included GPS accuracy, vehicle tracking, topographic interference, call reconnection, and remote service provision. These tests were created with input from the Evaluation Team and the technology partners who combined to create the tests' individual testing times, locations and protocols. This section provides these details as well as the lessons learned from the specific tests.

5.1 LOCATION SPECIFIC TEST

This test collected data regarding the systems' GPS accuracy. A vehicle would drive to a prearranged location with known coordinates and press a button, the call would be evaluated for GPS accuracy. Each technology was tested 50 times a day for two days, for a total of 100 tests each. A third scheduled testing day allowed for missed tests or other conflicts. Testing took place between 1 and 3 p.m. and allowed 5 minutes per test.

The following protocols were followed for this special test. Users were dispatched at noon and began pressing buttons at 1 p.m. Users were given a packet which included the exact locations where they were conducting the tests. Each user was equipped with a Cellular Phone for backup contact with the CSCs. The packets also contained a log sheet with the following information to be completed by the User at the start of each testing period:

Name:
Cellular Phone:
Date:
Weather:
Unit #:

The log sheet collected the following data:

Scheduled Time	Time Button Pressed	Connection?	
1:00		Y	N
1:10		Y	N

Table 5.1 describes the actions of the Motorola User during the Location Specific Test, while **Table 5.2** describes the actions of the Motorola CSC Operator.

Table 5.1: Motorola User Actions – Location Specific

1	**Press EMER button at scheduled time.**
2	Mark down time button pressed.
3	Wait for CSC operator to answer call with "PuSHMe, what are you reporting?".
4	With answer circle Y in Connection and note time of connection.
4a	If no answer within three redials, circle N in Connection and hit the END key.
5	Say, "This is a location test."
6	CSC Operator will say, "Thank You".
7	Say, "You're welcome."
8	**Terminate the call by pressing the END key and hanging up the handset.**

Table 5.2: Motorola CSC Actions - Location Specific

1	**When call appears answer with, "PuSHMe, what are you reporting?"**
2	**When the caller identifies the location test, say, "Thank You". Enter LT in call_notes.**
3	**When the user says, "You're welcome." Hit END CALL.**

Table 5.3 describes the actions of the XYPOINT User during the Location Specific Test, while **Table** 5.4 describes the actions of the XYPOINT CSC Operator.

Table 5.3: XYPOINT User Actions - Location Specific

1	Press NO button twice at scheduled time.
2	Mark down time button pressed.
3	System will beep while connecting.
4	System will connect and say "No Received" Circle Y in Connection and note time of connection.
4a	If no answer within 15 beeps, circle N in Connection and unplug the unit.
5	Screen will say "Verifying Location."
6	Screen will say, "Location Verified."
7	Screen will say, "PuSHMe".

Table 5.4: XYPOINT CSC Actions - Location Specific

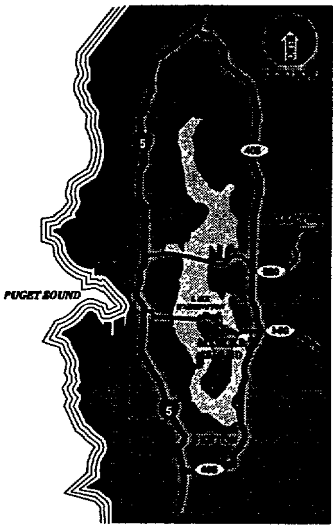
1	**When a "Double No" call appears, Select "Where R U"**
2	**When the location appears on the map, Terminate the call.**

The Location Specific Test was conducted between April 11-17, 1996. Three XYPOINT units and three Motorola units were deployed over four days. As described in chapter 4, the test vehicles drove to specific GPS confirmed locations and hit the pre-designated buttons. The users completed log sheets which identified date, weather, type of test, test number, location (latitude / longitude), address, and unit number.

In the CSCs, the operators identified the location test in their workstations by entering "loc#", where # is the number of the test, in the comments field. The operator answered the call, entered the designated test number, and informed the user of the location generated by the system.

The locations of these tests were GPS-confirmed locations obtained from WSDOT, the City of Bellevue and from DEA's survey department. The test vehicle were parked on, or as close as possible, to the monument or survey point. For the most part, the vehicles were able to park on the monuments, however in several cases WSDOT monuments were in the middle of a roadway and the vehicle had to park off on the side of the road. In future applications using GPS locations as a reference, the actual monument locations should be double-checked to ensure that safe testing is possible.

5.2 MOVING TEST



This test collected data regarding the systems' ability to track a call while the vehicle was in motion. Each call was tracked for 5 minutes along a prearranged route. The Motorola system was tested 25 times per day over four days, for a total of 100 tests. The XYPOINT system was tested 50 times per day over two days. A fifth scheduled testing day allowed for missed tests or other conflicts. Testing took place between 1 p.m. and 3 p.m. and provided 15 minutes per test. During the test, the CSCs were staffed with three people; four test vehicles were used. The moving test involved vehicles traveling the I-5 and I-405 corridors in mixed urban terrain.

Users were dispatched at noon and began pressing buttons at 1 p.m. Users were given a packet detailing the route they were to drive. The packet also contained a log sheet with the following information to be completed by the Users.

Name:
Cellular Phone:
Date:
Weather:
Unit #:

The log sheet also collected the following information:

Scheduled Time	Time Button Pressed	Connection?	
1:00		Y	N
1:10		Y	N

Table 5.5 describes the actions of the Motorola User during the Moving Test, while **Table 5.6** describes the actions of the Motorola CSC Operator.

Table 5.5: Motorola User Actions – Moving Test

1	Press EMER button at scheduled time.
2	Mark down time button pressed.
3	Wait for CSC operator to answer call with "PuSHMe what are you reporting?"
4	With CSC's circle Y in Connection and note time of connection:
5	If no answer within three redials, circle N in Connection and hit the END key.
[illegible]	Say, 'This is a moving test."
6	CSC Operator will say, 'Thank you."
7	Drive on route for 5 minutes.
8	Operator will say, "That was five minutes."
9	**Say, "Thank you."**
10	**Terminate the call by pressing the END key and hanging up the handset.**

Table 5.6: Motorola CSC Actions – Moving Test

1	When call appears answer with, "PuSHME what are you reporting?
2	When the caller identifies the moving test, say, "Thank you".
3	Enter MT into the comment box and hit TAB.
4	Set timer for five minutes.
5	When five minutes are up, tell user, "That was five minutes."
6	When the user says, "Thank you." Hit END CALL.

Table 5.7 describes the XY User Actions

Table 5.8 describes the XY CSC Actions

Table 5.7: XYPOINT User Actions – Moving Test

1	See narrative below

Table 5.8: XYPOINT CSC Actions – Moving Test

1	See narrative below

The Motorola moving tests were conducted February 5-8, 1996, and for XYPOINT on February 14, 1996. Two Motorola units and six XYPOINT units were deployed. Test vehicles drove along a set route and their speed and direction were tracked from the cscs.

One hundred tests were conducted for the Motorola system. Vehicles drove around the I-5 / I-405 loop. Users would call the CSC and be tracked for five minutes. This five minute interval was counted as one test. At the beginning of each day's testing, the user would fill in the daily information on their log sheets which identified the date, type of test, location, weather and unit number. At the end of each five minute test, the user would hang up and fill in the user forms which asked for the test number, the time of each button push, whether a connection was made, the time of connection and the general accuracy of the data as quoted by the CSC operator. Data was subjectively ranked excellent, good, fair or poor. Excellent information was at least 80% accurate, good was 60-80%, fair was 4060% and poor was below 40%.

CSC personnel were instructed to list MT in the comments field to note the time the user initiated the moving test. The operator then tracked the call for five minutes, quoting each five-second update of location and speed to the user who replied with the accuracy of the data. At the end of the five-minute call, the operator typed in their subjective measure of how accurate the data was using the same percentage codes listed above.

Six XYPOINT systems were deployed over two days to measure the ability of the system to track moving vehicles. Calls were made in rainy conditions in vehicles driving the I-5 / I-405 Loop. After a user initiated a call, they were then tracked for fifteen (15) minutes which was defined as a test. Thirty-six tests were conducted and were deemed to be sufficient, because the actual tracking time and data generated was more than the testing done for the Motorola system. A 15-minute window of time was used, as opposed to five minutes, because the test cars had to pull off the roadway and reset the units after each test.

Users in the vehicles filled in log sheets which identified the date, type of test, location, weather and unit number.

The user forms listed the test number, the time tracking began, the starting location, and the XYPOINT ID numbers.

CSC personnel were instructed to list MT in the comments field to note the time the user initiated the moving test. The operator then tracked the call for fifteen minutes, poling each unit approximately every two minutes. At the end of the test, maps were generated that show the movement of the vehicle through the XYPOINT system. These maps showed the accuracy of the tracking data. As shown in Figure 5.1, Each map showed several dots indicating position. One of the dots was a star, indicating the last dot on a page and the direction traveled. These maps were used by the evaluation team to judge the accuracy of the tracking. This attempted to allow the evaluation team to judge the accuracy of the data on a map – as the CSC operator would see it. This helped judge for map accuracy, which is an added variable to GPS accuracy in the location of incidents on a map display.

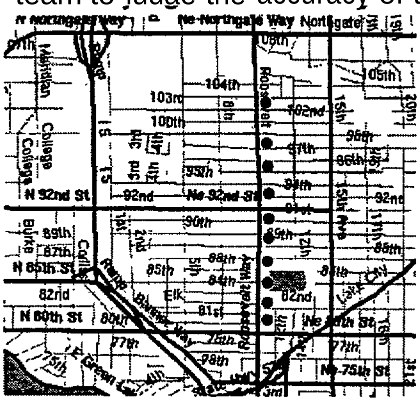


Figure 5-l XYPOINT Map

No alterations were made to this test or its procedures. No significant lessons were learned regarding the application of this type of test.

5.3 INTERFERENCE TEST

This test evaluates the ability of the devices to get a good GPS signal and connection to the CSCs in the presence of a variety of topographic interference possibilities. Each type of device was tested 50 times per day over a period of four days, for a total of 200 tests each. A fifth testing day was scheduled and allowed for missed tests or other conflicts. Testing occurred between 1p.m. and 3 p.m. Five minutes per test was allowed. CSCs were staffed with three people during this special test; four vehicles were actively tested The tests for interference involved testing in parking garages, between buildings, in a forest, and in open terrain. The units were deployed per interference type as follows:

Testing day 1 - Parking Garage (50);
Testing day 2 - Between Buildings (50);
Testing day 3 - Forests (50);
Testing day 4 - Open Terrain (50); and
Testing day 5 - Make up any Missed Tests.

Users were dispatched at noon and began pressing buttons at 1 p.m. Users were given a packet which included the locations for each test. The packet also contained a log sheet with the following information to be completed by the User:

Name:
Cellular Phone:
Date:
Interference Type:
Weather:
Unit #:

The log sheet requested the following data:

Scheduled Time	Time Button Pressed	Connection?	Good GPS?
1:00		Y N	Y N
1:10		Y N	Y N

Table 5.9 describes the actions of the Motorola User during the Interference Test while **Table 5.10** describes the actions of the Motorola CSC Operator.

Table 5.9: Motorola User Actions – Topographic Interference

1.	**Press EMER button at scheduled time.**
2.	Mark down time button pressed.
3.	Wait for CSC operator to answer call with "PuSHMe, what are you reporting?".
4.	With answer circle Y in Connection and note time of connection.
4a.	If no answer within three redials, circle N in Connection and hit the END key.
5.	Say, "This is a location test."
6.	CSC will verify GPS reading by telling you your location.
7.	If location is correct circle Y.
7a.	If CSC Operator cannot verify GPS Circle N.
8.	Say, "Thank you."
9.	**Terminate the call by pressing the END key and hanging up the handset.**

Table 5.10: Motorola CSC Actions – Topographic Interference

1.	When call appears answer with, "PuSHME, what are you reporting?"
2.	When the caller identifies the interference test, type VF in the comment box and click on map for location.
3.	When a location is given, tell the User the location.
4.	When the User says "Thank you" click on END CALL.

Table **5.11** describes the action of the XYPOINT user while **Table 5.12** describes the action of the XYPOINT CSC Operator during the Interference Test.

Table 5.11: XYPOINT User Actions – Topographic Interference

1.	Press NO button twice at scheduled time.
2.	Mark down time button pressed.
3.	System will beep while connecting.
4.	System will connect and say "No Received" Circle Y in Connection and note time of connection.
4a.	If no answer within 15 beeps, circle N in Connection and unplug the unit.
5.	Screen will say 'Verifying location."
6.	Screen will say "Standby for Location."
7.	Screen will give a description of your location (e.g. 145th and Aurora)
7a.	If location is correct circle Y and hit Yes button.
8.	If CSC Operator does not verify GPS, circle N and hit No button.
9.	Screen will say either "Yes Received" or "No Received."
10.	CSC will terminate call and send vou a 'PuSHMe" messaae.

Table 5.12: XYPOINT CSC Actions – Topographic Interference

1	**When a "Double No" call appears, Select "Where R U"**
2	**When the location appears on the map, relate the location to the User. (e.g. 145th and Aurora).**
3	When User responds Y or N, terminate the call.

The topographic interference tests were conducted January 22-25, 1996. To provide data for measuring the effects of topographic barriers on PuSHMe technologies. Following UW's evaluation plan criteria, two units were deployed over four days to measure communications from various locations exhibiting topographic interference characteristics. The evaluation plan required that testing be conducted in parking garages, forests, urban canyons, and open terrain. Fifty tests per device were conducted in each of these conditions.

- Tests on January 22 evaluated parking garages.
- Tests on January 23 evaluated urban canyons.
- Tests on January 24 evaluated forests.
- Tests on January 25 evaluated open terrain.

Users in the vehicles filled in log sheets which identify the date, type of test, location, weather and unit #. Users split their tests between locations to ensure that they weren't in a "dead spot" or other anomaly.

User forms listed the test number, the time, whether a connection was made, time of connection, and whether or not there was good GPS. Good GPS was listed as "Y" if it was on target, "N" if it was radically off target, and the actual screen location was quoted if it was "close" – this allowed the evaluation team to judge the accuracy of the location.

CSC personnel were asked to list "tt" in the comments field to note that the test was a topographic interference test. The operator would answer the call, enter "tt" in the notes field when the user identified the topographic test, and quote the location information to the user.

No alterations were made to this test or its procedures. The only significant lesson learned centered around the acquisition and memory of GPS signals. The Motorola device continues to transmit its last known location. The XYPOINT system, on the other hand, treats each incident as a unique event and seeks for a new GPS location. This resulted in apparent correct locations on the Motorola system when a vehicle was in a parking structure. This was because the end location of the vehicle was in the GPS range of acceptable error. The system would acquire a GPS signal shortly before entering the structure and then that location would display from then on.

The Motorola system displayed levels of accuracy or quality for the GPS data. This was coded by the system as 3D, 2D or old. 3D data indicated a GPS signal that was gathered with by three or more satellites. 2D data was one or two satellites and old was simply old data with no update. The XYPOINT system provided information regarding whether the location information was differentially corrected, but not the quality of the base data. This allowed the evaluation team to determine the quality of information gathered by these tests.

5.4 DROPPED CARRIER

This test collected data regarding the systems' ability to reconnect a call after the connection has been broken. Each test broke connection and attempted to reestablish as the same call at the CSC. The Motorola system was tested 50 times a day for two days, for a total of 100 tests each. A third scheduled testing day allowed for missed tests or other conflicts. Testing will took place between 1 and 3 p.m. and allowed 5 minutes per test. CSCs were staffed with 3 people during this special test. The dropped carrier tests took place in open terrain only.

The following protocols were followed for this special test.

Users were dispatched at noon and began pressing buttons at 1 p.m. Users were given a packet which included the locations where they were conducting the tests. The packet also contained a log sheet with the following information to be completed by the User.

Name:
Cellular Phone:
Date:
Location:
Weather:
Unit #:

The log sheet collected the following data:

Scheduled Time	Time Button Pressed	Connections?	Time of Connect	2nd Connection?	Time of 2nd Connection?	Valid Reconnection?
1:00		Y N		Y N		Y N
1:10		Y N		Y N		Y N

Table 5.13 describes the actions of the Motorola User during the Dropped Carrier Test, while **Table** 5.14 describes the actions of the Motorola CSC Operator.

Table 5.13: Motorola User Actions - Dropped Carrier Test

1	**Press EMER button at scheduled time.**
2	Mark down time button pressed.
3	Wait for CSC operator to answer call with "PuSHMe, what are you reporting?
4	With answer circle Y in Connection and note time of connection.
5	Say, "This is a drop test."
6	CSC Operator will say, "Please disconnect."
7	Unhook the antenna.
8	Verify that call is lost by listening on phone.
9	Reconnect Antenna. Note time of connection.
10	Wait for call to be answered by CSC. Enter Time in 2nd Connection.
10a	If no answer within three redials, circle N in Connection and hit the END key.
11	Say, "This is a reconnect."
12	If CSC Verifies successful reconnect circle Y in Valid Reconnection. If not, circle N
13	Say, 'Thank You."
14	**Terminate the call by pressing the END key and hanging up the handset.**

Table 5.14: Motorola CSC Actions - Dropped Carrier Test

1	**When call appears answer with, "PuSHME, what are you reporting?"**
2	When the caller identifies the drop test, say, "Please disconnect".
3	When the call icon reads "LOST" enter FD into the comment box and hit TAB.
4	In a few minutes, the LOST icon should be replaced with an active one.
5	Answer that call, "PuSHMe, what are you reporting?
6	The user will identify the call as a reconnect.
7	Enter AR in the comments box and hit TAB.
8	Say, "This is a successful reconnect."
9	When the user says, "Thank you." Hit END CALL.

The Dropped Carrier Test was conducted January 31 through February 2, 1996 to provide data for measuring the ability of the devices to reconnect as the same call after the call has been inadvertently interrupted. Following UWs evaluation plan criteria, two units were deployed over four days to measure the ability of the units to reconnect after connection was broken. Calls were made in good conditions and then interrupted by unhooking the antenna on the Motorola units. During this phase of the testing, only Motorola units were tested. One hundred tests were conducted.

Users in the vehicles completed log sheets which identify the date, type of test, location, weather and unit number.

The user forms listed the test number, the time, whether a connection was made, time of connection, time the antenna was unhooked, time the second connection was made and if it was a valid reconnection. A valid reconnection is if the call was reestablished as the same call - with the same call ID.

The CSCs were instructed to enter "FD" in the comments field to note the time the user was requested to unhook the antenna. When the call was successfully reconnected the operator entered "AR" in the comments field.

No alterations were made to this test or its procedures. No significant lessons were learned regarding the application of tests of this type.

5.5 NATION-WIDE TEST

This test demonstrated how the Motorola system could answer calls from one part of the county in another part of the county. For this test, users followed the procedures for the Partial Field Operational Test. Twenty-five tests were conducted per day over a two day period, for a total of 50 tests. Calls were made from Seattle to the CSC in Phoenix. A third scheduled testing day allowed for missed tests or other conflicts. Testing occurred between 1 p.m. and 3 p.m. and allowed five minutes per test. The nation-wide test involved testing in open terrain only.

Users were dispatched at noon and began pressing buttons at 1 p.m. Users were given a packet detailing the testing locations. The User would fill out the log sheet in the packet with the same data collected from the Partial Field Operational Test:

Table 5.15 describes the actions of the Motorola User during the Nation-wide Test, while **Table 5.15** describes the actions of the Motorola CSC Operator.

Table 5.15: Motorola User Actions - Nation-wide

1	Press button at scheduled time.
2	Mark down time button pressed.
3	Wait for CSC operator to answer call with "PuSHMe, what are you reporting?
4	With answer circle Y in Line #6.
4a	If no answer within three redials, circle N in line #6 and hit the END key.
5	Tell the operator the button pushed.
6	CSC Operator will say, "This test is now completed."
7	Say, "Thank you."
8	**Terminate the call by pressing the END key and hanging up the handset.**

Table 5.15: Motorola CSC Actions - Nation-wide

1	When call appears answer with, "PuSHME, what are you reporting?
2	When the caller identifies the button pushed, say, "This test is now completed", enter VF in the comment line, and hit TAB.
3	When the user says, "Thank you." Hit END CALL.

The Nation-wide Test was conducted May 22-23, 1996 to provide data that will evaluate the operation of remote CSCs.

One Motorola unit was deployed over a two-day period to locations within King and Snohomish counties in Washington State. The locations were selected randomly by a Project employee. Locations consisted primarily of cross-street intersections. Additional test locations included highways and remote arterials. Fifty tests were conducted during the two-day period.

The User drove to a random location to initiate a test call from the Motorola unit. The User would then complete a log sheet which identified date, test number, location, time initiated, time contacted, location verified, and button pushed.

For the tests which were conducted at intersections, the vehicle's bearing, with respect to the intersection, was recorded prior to initiating the test. For example, the User would note where the vehicle was parked (e.g. northwest, northeast, southeast, or southwest comer) with respect to the intersection. The project staff would then write the location verified from the Motorola response center, including the streets and the bearing, if possible. For the tests which were conducted on highways and remote arterials only,, the street addresses were recorded.

CSC operators for this test were located in the Motorola office in Phoenix, Arizona. The CSC operator would answer the call, confirm the button pushed, and the test number. The operator would then follow-up by quoting the location information for the given test number. Upon verification of the information the test would conclude. An observer from the project team was present at the Phoenix CSC for the duration of the test.

No alterations were made to this test or its procedures. No significant lessons were learned regarding the application of tests of this type.

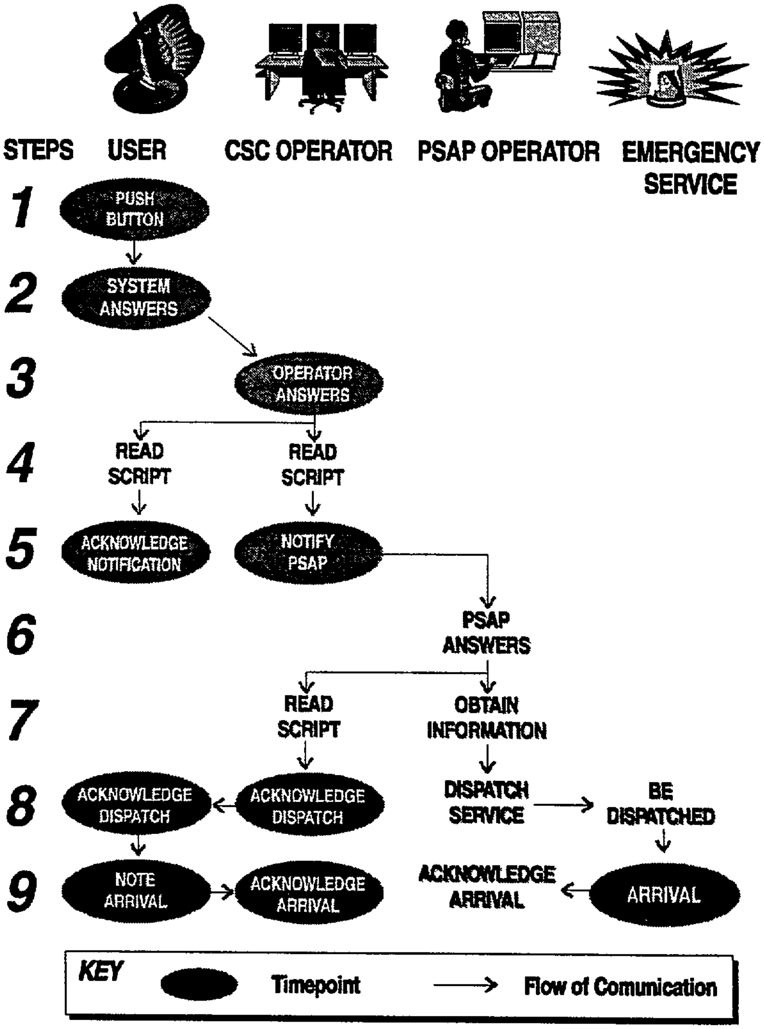
6.0 EXECUTION OF THE FULL FIELD OPERATIONAL TEST

The Full Field Operational Test for the PuSHMe project was designed to simulate an emergency call from its inception to the arrival of emergency service. Approximately 175 of the tests evaluated the value of the information generated from the mayday devices, the usability of the mayday devices, and the abilities of the operators using the XYPOINT and Motorola technologies to communicate with the service providers. This exercise involved users making a call to the service center, the service center recognizing their call, the service center passing the call on to a Service provider, and the Service provider dispatching service to the scene. The Full Field Test established protocols to pass data on to the Service provider.

6.1 FULL FIELD TEST STRUCTURE

The Full Field Operational Test relied on a series of scenarios. Mayday device users and CSC Operators were provided scripts to follow. After receiving the call, the mayday CSC operators routed the emergency to either the King County Police, the American Automobile Association or the WSDOT Incident Response Team, based on the nature of the simulated event. The service provider operators would then determine the details of the PuSHMe call and dispatch service. At key points, times were recorded by all participants except the service provider operators, who filled out forms when time permitted. **Figure 6.1** shows a general flow of the test with example time points.

Figure 6.1: PuSHMe Full Field Test Flow



6.2 PUSHME DEVICE USER RESPONSIBILITIES

Each PuSHMe device user was sent into the field with a script providing a scenario, a location, and a dialog. The script provided details of the scenario (information and verbiage) as well as time points for recording the key points in a mayday call. For the Motorola device, the time points included the time the button was pushed, the time connected to the system, the time the call was answered, the time emergency services were notified, the time service was dispatched, the time service arrived, and the time the call was closed. For the XYPOINT device, the time points recorded the time the button was pushed, the time of first reply, the time the emergency services were notified, the time service was dispatched, the time service arrived, and the time the call was closed. Device users made the call and followed the script. When emergency service arrived, the PuSHMe driver gave the field unit a response form.

6.3 CSC'S RESPONSIBILITIES

The CSC operator was given a script similar to the user's script, but with the location information removed (see **Figures** 6.4 and 6.5). The CSC operator also had a CSC Overview that listed the appropriate service provider to be contacted for each test (see **Figure 6.6).** The CSC operator answered the call, followed the script, called the appropriate service provider, identified the call as a PuSHMe simulation, gave the required information (location, incident, car and driver information), notified the driver when service was dispatched and closed the call when service arrived.

6.4 SERVICE PROVIDER DISPATCHER'S RESPONSIBILITIES

The service provider dispatchers answered calls from the PuSHMe CSCs. The calls were identified as a PuSHMe simulation and the dispatchers notified field units. The dispatcher then completed a form requesting feedback on the usefulness of the PuSHMe information.

Much of the standard information requested by the E-911 operators was omitted when a call was turned over to the King County Police. For example, if the simulated incident was for a stabbing, a detailed description of the suspect, the location of the wound and other details were intentionally left out. What was conveyed was the type of incident, the location, and the personal details about the caller and the vehicle.

The decision to use a lower level of revealed data was made for a variety of reasons. First, the tests were designed to isolate critical PuSHMe data - the location and customer information data. Long, detailed scenarios, conducted under low stress situations, could potentially cloud the performance evaluation of the system by providing skewed time data. Second, information about the suspect would be conveyed to the officers over the radio which is heard by other non-participating agencies and could be acted on improperly. Third, the agencies in the focus groups and individual interviews indicated that in such an event (where such a large amount of information would need to be exchanged) the caller should be patched directly to the service provider, a feature neither system could support at the time of testing.

Figure 6.2: Motorola User Script

PuSHMe Full System Test Log

Motorola

Test Code: MOTO 17

3/l 3/96	**Test #: 22**	**Vehicle: Bronco**	**612-3795**
Location: End of NE 138th St			

Scenario: Two people beat you with baseball bats.

PUSH: EMER button

		GPS Time
	(Time button PuSHed)	
	(Time connected)	
CSC	PuSHMe, What are you reporting?	
User:	Full system **test # <Test Code>** **I've been beaten.**	
CSC:	When did this happen?	
User	Fifteen minutes ago.	
CSC:	Are you breathing normally?	
User:	Y E S	
CSC:	(Confirms name, location, vehicle from User Profile.)	
Used	**(Responds appropriately.)**	
CSC:	I am notifying the police.	
User:	**(Wait for operator to return.)**	
CSC:	Service dispatched.	
User:	**(Hit END)**	
User:	**(Emergency service arrives - call CSC on cell phone at 4404787.)**	
CSC:	PuSHMe Center	
User:	**This is test ___, service arrived at :______**	
CSC:	Thank you	
	(Time call closed)	

Give paperwork to emergency service personnel.

CSC phone number (206) 4404767

Figure 6.3: XYPOINT User Script

PuSHMe Full System Test Log

Test Code: SEN002

xyPoint

3/13/96 Test #: 22 **Vehicle:** Taurus 163

Location: **NE 168th** St and 204th Ave NE

Scenario: Your vehicle has been vandalized.

PUSH: 911 button

		GPS Time
	(Time button PuSHed)	
	(Time connected)	
CSC:	Confirm 911	
User:	YES	
CSC:	Can we call you on your cell phone?	
User:	YES	
CSC:	Can you confirm incident @ **"LOCATION"?**	
User:	**(Respond appropriately.)**	
CSC:	(Operator calls PSAP)	
CSC:	Service notified.	
CSC:	Service dispatched.	
CSC:	Has dispatched arrived?	
User:	NO **(until dispatched service arrives)**	
User:	**YES (when dispatched service arrives)**	
CSC:	Disconnecting	
CSC:	PuSHMe	
	(Time call closed)	

Give paperwork to emergency service personnel.
CSC phone number: (206) 328-6000

Figure 6.4: Motorola CSC Script

PuSHMe Full System Test Log (CSC)

Test Code: MOTO 17

Motorola

3/13/96	**Test #: 22**	**Vehicle:** Bronco	612-3795

Scenario: Two people beat you with baseball bats.

PUSH: EMER button

		GPS Time
	(Time button PuSHed)	[redacted]
	(Time connected)	[redacted]
CSC:	PuSHMe, What are you reporting?	[redacted]
User:	**Full system test # <Test Code>** **I've been beaten.**	[redacted]
CSC:	When did this happen?	[redacted]
User	**Fifteen minutes ago.**	[redacted]
CSC:	Are you breathing normally?	[redacted]
User:	YES	[redacted]
CSC:	(Confirms name, location, vehicle from User Profile.)	[redacted]
User:	**(Responds appropriately.)**	[redacted]
CSC:	I am notifying the police.	[redacted]
User:	**(Wait for operator to return.)**	[redacted]
CSC:	Service dispatched.	[redacted]
User	**(Hit END)**	[redacted]
User.	**(Emergency service arrives - call CSC on cell phone at 4404787.)**	[redacted]
CSC:	PuSHMe Center	[redacted]
User:	**This is test ____ service arrived at :_____**	[redacted]
CSC:	**Thank you**	[redacted]
	(Time call closed)	[redacted]

Figure 6.5: XYPOINT CSC Script

PuSHMe Full System Test Log (CSC)

Test Code: SENO 2 5

xyPoint

3/13/96	**Test #: 22**	**Vehicle:** Bronco 85

Scenario: Your radio has been stolen,

PuSH: 911 button

		GPS Time
	(Time button PuSHed)	[redacted]
	(Time connected)	
CSC:	Confirm 911	[redacted]
User!	YES	
CSC:	Can we call you on your cell phone?	
User:	N O	
CSC:	Are you in imminent danger?	
User	(Respond appropriately.)	
CSC:	Emergency in Progress?	
User:	(Respond **appropriately.)**	
CSC:	Can you confirm incident @ “LOCATION”?	
User	**(Respond appropriately.)**	
CSC:	Can you go to a phone & dial 91 l?	
User:	N O	
CSC:	(Operator calls PSAP)	
CSC:	Service notified.	
CSC:	(Other questions are asked.)	
User:	**(Respond appropriately.)**	
CSC:	Service dispatched.	
CSC:	Has dispatched arrived?	
User.	**NO (until dispatched service arrives)**	
User:	YES **(when dispatched service arrives)**	
CSC:	Disconnecting	
CSC:	PuSHMe	
	(Time call closed)	[redacted]

Figure 6.6: CSC Directions

CSC Overview Motorola 3/13/96

Bronco 6 12-3795

Test #	Test Code	Scenario	PSAP
22	MOT017	Two people beat you with baseball bats.	KCP
23	MOT004	You have been hijacked.	KCP
24	MOT046	You've smashed your fingers in the vehicle door.	WDOT

Honda 6 12-2873

Test #	Test Code	Scenario	PSAP
22	MOT041	You saw a cyclist get hit by a car.	WDOT
23	MOT050	You saw a cyclist get hit by a car.	WDOT
24	MOT035	A car ran into your vehicle. Your right arm is broken.	WDOT

Morgan's 612-3792

Test #	Test Code	Scenario	PSAP
22	MOT081	You see a stalled Chevrolet with its hood up at the side of the road.	AAA
23	MOT091	You have a flat tire and no spare.	AAA
24	MOT077	You see a stalled Chevrolet with its hood up at the side of the road.	AAA

Taurus 612-3791

Test #	Test Code	Scenario	PSAP
22	MOT048	**Your** passenger suffered a heart attack.	WDOT
23	MOT053	You saw a cyclist get hit by a car.	WDOT
24	MOT044	You have broken your leg.	WDOT

6.5 EMERGENCY RESPONSE RESPONSIBILITIES

The field units for AAA, WSDOT Incident Response, and the King County Police responded to calls over the radio in a standard fashion. The call was identified as a PuSHMe simulation, the emergency vehicles proceeded to the location of the PuSHMe driver, did not use emergency lights or sirens, and filled out a form presented to them. This form was identical to the form provided to the Dispatcher.

6.6 TEST VARIATIONS

There were two variations of the PuSHMe Full Field test. The main test allowed users to refine the GPS information. Users went to a location, the CSC operator would communicate their location provided by the GPS system and the user would refine the location. For example, the CSC operator might ask the user if they were on the east or the west side of a street. PuSHMe mapping programs displayed large emergency icons on maps that had thin lines for roadways where the CSC could tell the street the user was on, but not the side or orientation of the car. Blind tests were performed to simulate situations in which the user has no idea of, or is unable to communicate, their location. Units were dispatched using the first GPS location only.

6.7 TEST LIMITATIONS

Limitations of the Full Field Operational Test were that there was:

- no measurement done for peak cell / peak hour usage;

  Peak cell or peak hour usage could impact the ability of a call to get through, especially with a flood of repeat calls.

- no highly detailed event specific discussion;

  Detailed event specific discussion between the user and the CSC, the CSC and the service provider, and the service provider and the field units would provide a more realistic sense of a call's processing time.

- no factoring for stress; and

  Stress on the part of the caller could impact their ability to relate pertinent information in an unusual or emergency situation. Stress in the service provider can likewise effect the handling of the call.

- the system lacked the ability to transfer calls directly to the service providers.

  The system's lack of direct voice call forwarding capabilities did not allow the CSC to put the service provider in direct contact with the user. The emergency service providers repeatedly requested this capability in interviews and focus groups.

These features affect the operation of a PuSHMe style system. With the exception of voice transferring, the limitations are variable and contingent on several factors independent of the design and operation of a PuSHMe system. These limitations would also impact direct E-91 1 calls. However, these factors mean that the duration of a

PuSHMe full field simulation will not directly equate with the duration of an actual emergency.

6.8 RESULTS AND LESSONS LEARNED

The statistical analysis of the Full Field Operational Test is being conducted by the independent evaluator, but several lessons were learned through establishing the testing protocols and conducting the test. Learning the data needs and protocols of just a few service providers demonstrated the differences in their operations. AAA was interested in the vehicle description, the customer's name, the location and a brief description of the situation. King County Police required much more information depending on the emergency. They required the same information as AAA, plus criminal or event information which could become very involved. WSDOT Incident response requested the vehicle location and description only. In general the needs for voice contact, adequate mapping, call processing speed, and understanding existing protocols for each service provider were very important to the successful handling of a call.

6.8.1 Voice Contact

For Full Field tests, the cellular phone technology was highly useful. Emergencies and location information were quickly communicated. The two-way pager technology necessitated a series of questions to refine the location and relate the problem. In situations where the user has no idea of their location, the phone based technology allows the operator to ask important refining questions, which improves the type of information the CSC presents to the service provider.

6.8.2 Accurate and Adequate Mapping / Differential GPS

Differential correction of GPS data and adequate mapping were also very important. For both of the participating technologies, the map database was inconsistent in its accuracy. In some parts of the region, the vehicle was spotted on the map very close to its actual location and in others it could be up to a mile off. This was not a GPS error, but a mapping error because, in certain locations, vehicles showed up on CSC maps consistently in the same incorrect location. If the location was being incorrectly read by GPS, it would vary from call to call. A mayday system will rely on the GPS information' being differentially corrected and fed to accurate maps that are read and interpreted by operators.

6.8.3 Processing Speed

Another issue is the speed at which location and incident type can be determined. If the mayday device takes more than a few minutes to determine location and incident type, then it may add an unacceptable amount of time to a call. The average cell phone call at a 911 center today takes about two minutes to dispatch service. This is with 30 percent of the calls having less than accurate location information. Mayday service automation could provide a faster response by directly sending information to the service providers through the CSCs. With this type of automation, the user would call the CSC which would process their information and pass the call or send a fax to a service provider with no CSC operator involvement. The service provider would get the location information and the incident type, along with the subscriber's personal information. If it was attached to a phone, there would be voice contact. If it was a pager system there would be a call back number that the service provider could dial to contact the user. This could facilitate faster processing, providing the service provider more information than they have today and the voice contact they desire.

6.8.4 Institutional Lessons

The institutional lessons learned in the PuSHMe Full Field Operational Test were the need for protocols for information transfer, an understanding of the data needs of the service providers, and a clear understanding of jurisdictional boundaries. It was learned that direct voice communication with the user was useful in refining location and situation information.

The main challenges for implementing Mayday technologies will be institutional. Coordinating the PuSHMe Full Field test with area PSAPs and response agencies was a logistical undertaking involving many meetings, multiple iterations of protocols, scheduling of test dates, understanding geographic boundaries and answering agency expectations. This was a limited test using only a few service providers for a few days. The establishment of a permanent private emergency service center could be much more involved.

The goal of both the CSC and the service provider is the rapid and complete servicing of an emergency call. When a CSC begins service, it should adhere to the current best industry practices regarding communications, training and operations.

6.9 SYSTEMATIC LESSONS LEARNED

One revision to the PuSHMe test concerned the forms originally issued to PSAP and response center dispatchers. Dispatchers were unable to complete these forms because they were too busy with their normal duties. Since much of the information requested on the dispatch form was time-dependent, this led to poor data in this area. Consequently, the forms at the vehicle, which were completed by both the Users and the response personnel, were amended to capture some of this data.

Finally, it was felt that some of the time taken to process a PuSHMe Full Field simulation was due to the low level of training of the PuSHMe operators. It is assumed that call-processing in real circumstances will reflect these discrepancies, and that overall call response time would improve. It was shown that call transfer time and operator training were very important in the handling of calls.

7.0 DATA COLLECTION, PACKAGING AND DISTRIBUTION

This section describes the collection, packaging and distribution of data by the PuSHMe Partners to the Evaluation Team. This includes the collection of forms and computer information, the development and use of the System Monitoring Workstation (SMW) and the transfer of data from the XYPOINT and Motorola systems to the SMW.

7.1 BACKGROUND

The data for the PuSHMe project was evaluated by the project's independent evaluation team, The University of Washington Department of Technical Communications. The PuSHMe Partners collected data as outlined in the *Detailed Evaluation Han.*

7.2 DATA DISTRIBUTION

Electronic data was provided weekly via a File Transfer Protocol (FTP) site on the Internet. Forms and written data were provided monthly or as collected for individual specific tests. Specific test data was also submitted with a memo describing the test activities.

The quantitative analysis, as defined by the evaluation plan, required the collection of real-time data characterizing the system performance for both PuSHMe systems participating in the project. As a result, the data coming from both the XYPOINT and Motorola systems needed to be reconciled.

Both systems collected and stored their own data in separate databases and in different formats; therefore, the quantitative analysis of the PuSHMe Demonstration Project required a method to:

- interface with the two PuSHMe systems;
- filter the data provided by each system; and
- store all the project data in an evaluation database.

The SMW was developed to address these specific goals and consolidate the data required by the evaluation team.

7.3 SYSTEM MONITORING WORKSTATION DEVELOPMENT

The goals defined above identify three required functions of the SMW: communication, processing and storage. First, the SMW needed to communicate with the PuSHMe systems to receive their data. Next, the data needed to be filtered and ordered to match the requirements of the evaluation team. Finally, the data was stored and made available to the evaluation team.

7.3.1 Data Input - Motorola

The Motorola system collected a wide variety of data used both for display purposes and post-event evaluation. The Motorola data was stored in the form of two tables: the call table and the position table shown in Tables 7.1 and 7.2. Motorola developed special software which allows for the transfer of a relevant subset of the Motorola data.

Table 7.1: Motorola Call Table

Field Name	Field Type	Length
alarm_code	char	10
call_close_time	hh:mm:ss	8
call_date	mm/dd/yy	8
call dispostion	char	256
call-id	char	20
call-notes	char	256
call_time	hh:mm:ss	8
call-timestamp	hh:mm:ss mm/dd/yy	1 7
call-vehicle-id	char	12
closed	integer	4
cumulative-hold	integer	4
oper_id	char	10
position-time	hh:mm:ss	8
selected-call	integer	2
telco_line	integer	4
time_placed_on_hold	hh:mm:ss	8

Table 7.2: Motorola Position Table

Field Name	Field Type	Length
call_id	char	20
corr_applied	integer	2
corr_height	floating point	4
corr_lat	double precision floating point	8
corr_lon	double precision floating point	8
DOP	floating point	4
heading	integer	2
position_time	hh:mm:ss	8
rec_stamp	hh:mm:ss	8
used	integer	2
veh_id	char	12
velocity	integer	2

The SMW was located at the WSDOTs Transportation System Management Center and was configured to receive data transmitted through a serial connection. Motorola data was transmitted to the SMW every five seconds during an active calls.

7.3.2 Data Input - XYPOINT

The XYPOINT system logged all data records generated for each event in the system including communications from the field, communications to the field and operator entry. **Table** 7.3 defines the format of the XYPOINT data log.

Table 7.3: XYPOINT Record Log Definitions

Field Name	Field Type	Length
Operator Identification	**char**	**3**
Shift Number	**char**	**1**
Date	yymmdd	6
Call Tracking Number	char	4
Time	hh:mm:ss	8
Plush-Button ID	char	1
IP Address (Vehicle ID)	xxx.xxx.xxx.xxx	15
One Field Containing	(format definedbelt)	100
GPS Info Header	char	4 (">RLN")
GPS Time of Dav	char	8
Latitude	char	10
Longitude	char	14
various GPS information	char	77
or		
Evaluation Code	char	100
or		
Text entered by the operator	char	100

The XYPOINT data record log was transmitted to the SMW on a weekly basis. The SMW was configured to receive the data over a dedicated dial-up modem line.

7.3.3 Data Processing

The main function of SMW data processing was to populate the evaluation database with data extracted from the records provided by both participating PuSHMe systems. The data processing was developed in four steps:

1. identification of the desired database elements;
2. reconciliation of desired data set with PuSHMe data sources;
3. definition of the evaluation database; and
4. development of software to filter the data and populate the database.

Step I– Desired Database Elements

The evaluation team identified the desired data collection requirements through their quantitative analysis description. These requirements provided a desired set of data elements directly corresponding to specific events encountered in a generic PuSHMe system response. **Table 7.4** displays the data elements and the associated events for which the data was collected.

Table 7.4: Data Requirements Defined by Evaluation Team

Generic Event Description	Data Source	Time Stamp	Call ID	Vehicle ID	Position	Event Type	Weather	Environment	Comment
User Activates Device	**User Response Form**	*	*	*	*	*	*	*	*
Control Center Computer Receives and Logs Request	Help Me System (Operator Entered)	*	*	*	*	*			*
Control Center Operator Identifies and Logs Incident	Help Me System (Operator Entered)	*	*	*					*
Control Center Operator Contacts User to Verify Request	Help Me System	*	*						*
User Verifies Operator-Echoed Information	User Response Form	*							*
Control Center Logs Service Dispatch Request	Help Me System (Operator Entered)	*	*	*	*	*			*
Emergency Service Dispatcher Receives Request	Service Dispatch Response Form	*	*	*	*	*			*
Service Arrives at User's Position	User Response Form	•							*
Control Center Operator Verifies Arrival of Service	Help Me System (Operator Entered)	•	*						*
User Acknowledges Service Arrival and Logs Out	User Response Form	*							*
Control Center Operator Logs out	Help Me System (Operator Entered)	*	*						*

Step 2 - Data Reconciliation

The desired set of data elements and collection schedule were reconciled with the data available from each system. This allowed the team to establish which data elements could be supplied automatically by each PuSHMe system. It was attempted to use automated data collection as much as possible, but some events and some data elements were not recorded by one or both PuSHMe systems. For events which the desired data could not be collected, other data sources were used including user response forms and special, operator-entered data. Table 7.4 identifies the data sources for each event.

Step 3 - Evaluation Database

The third step .involved the definition of an evaluation database based on the data required from the evaluation plan. The data record defined for the Motorola system contained most of the data elements described in Table 7.4. The XYPOINT data records represented a subset of the data elements available from the Motorola system. Therefore, the Motorola record format was adapted to become the evaluation database format. Table 7.5 summarizes this database format describing the availability data from the PuSHMe systems.

Table 7.5: Description and Format of Evaluation Database on the System Monitoring Workstation

Field Name	Type	Field Size	Description
call_id	char	20	**A unique identification code associated with the call. All records with the same call_id are generated as part of the same call.** For Motorola, this code is generated by concatenating the Motorola's vehicle identification with the initial time of the call. For XYPOINT, this code is generated by concatenating the three character operator identification, a blank, the eight character session number, another blank and the four character tracking number
vehicle_id	char	12	The unique identification assigned to the vehicle for the duration of the operational test. -
call_alarm	char	10	This is the call type dependent on the button pushed on the field units. For XYPOINT, only the first record of the call will contain data in this field.
call_date	char	8	The date (mm/dd/yy) the call was initiated.
call_time	char	8	The time (hh:mm:ss) the call was initiated.
call_stamp	char	17	This is a date and time stamp (mm/dd/yy hh:mm:ss) associated with each individual record. The order and timing of records associated with a call are determined bv this time stamp.

Field Name	Type	Field Size	Description
closed	num	4	**An integer indicating the status of the call.** For Motorola, this value can either be 0, 1, or 2. A 0 indicates that the call is open. The other values indicate stages of the call closing procedure. For XYPOINT, the values is always 0.
call-close	char	8	The time stamp associated with the closing time for the call.
corrapp	num	2	This field indicates a value related to the differential correction applied to the GPS data.
corrlat	num	10	The differentially corrected latitude.
corrlong	num	11	The differentially corrected longitude.
corrheight	num	11	The differentially corrected height. For XYPOINT., this field contains the seconds past 00:00 GMT that the reading was made.

Step 4 - Software Development

Specific communications software was prepared for each PuSHMe system. This software was designed to run continuously on the SMW, processing the transmitted data via either serial connection or modem. Processing involved reading the data records from both PuSHMe systems, parsing the data fields contained within these records, and populating the evaluation database with the appropriate values.

7.3.4 Data Storage

The format of the evaluation database is presented in Table 7.5 and contains data from both PuSHMe systems. This database resided on the SMW and was archived on tape and other PCs. When data was archived, the database file was purged in order to keep the database file at a manageable size.

7.3.5 Electronic Data Distribution

Periodically, data was exported from the database to create separate files representing weeks of data. The data was further subdivided based on the source PuSHMe system. These files were transmitted to the evaluation team via an FTP site.

7.4 FORM DATA COLLECTION AND DISTRIBUTION

For each of the PuSHMe evaluation tests, form-based data was collected to enhance the electronic data. This data generally included information regarding the participants and temporal data like weather, location type (rural, urban, suburban), whether or not the call went through, and how many attempts the system had to make to connect the call. The evaluation team reconciled the form-based data with the electronic data to create a total picture of both the human and electronic aspects of the Mayday test.

For the Partial Field Operational Test, the form-based data was collected from volunteers monthly. A packet of forms was mailed to volunteers or groups of volunteers and the forms from the previous month were mailed back to DEA. After the forms were collected, they were logged by DEA and sent on to the evaluation team. Any data forms not sent in by the volunteers were retrieved manually by DEA staff and turned over to the evaluation team.

For the Special Tests and the Full Field Operational Test, the forms used during the test were completed by DEA or WSDOT staff or were administered directly to Emergency Service Personnel. This direct data collection appeared to be more reliable than the volunteer data collection method. Forms were collected at the end of these tests, combined with a memo describing the test procedures and distributed to the evaluation team.

The evaluation team was responsible for all data entry and data manipulation regarding form-based data.

7.4 LESSONS LEARNED

The system monitoring workstation development process revealed lessons regarding data management, system interoperability and data transfer. In the Mayday arena, location information is the most important key. This data follows existing standards of communication and is unique in being easily portable from system to system. This location data has been identified as the most important piece of the Mayday data set by emergency service providers. Other value-added information will need to conform to standards currently being developed.

8.0 CONCLUSIONS

The PuSHMe project's User Deployment phase went smoothly and provided usable data to the Evaluation Team. The project tested three major areas: system reliability (the Partial Field Test), system features (the Specific Tests), and functionality (the Full Field Test). This testing used about 200 volunteers and dozens of staff members. The project tested about 200 devices, two CSCs and two separate Mayday technologies. Lessons learned during testing were, by and large, confined to three areas: staffing, system functionality and institutional issues.

8.1 STAFFING

In the area of staffing, the PuSHMe test found that the use of temporary personnel in non-emergency situations performed differently than trained personnel would in real-life conditions. This led to slower performance of the system and inconsistent call handling. Since there were no Mayday systems in operation at the start of the PuSHMe simulations, there were no industry standards to follow. The roles and scripting of the various tests therefore evolved as the tests progressed. In future tests and in the implementation of actual Mayday service, training will be required to provide necessary levels of service and response times.

Volunteer Management was also a large part of PuSHMe It was found that making volunteers feel like active participants in the project is helpful in data collection. Volunteers must be kept active and participating in order to hold their interest.

8.2 SYSTEM FUNCTIONALITY

The systems performed well, in terms of calls completing and the system functioning as designed. The prototype nature of the various system components created some setbacks, but, the system provided all information required by the Evaluation Team. The systems did have problems with components, most notably DGPS. The ability to easily monitor the components of products in testing was shown to be important to attaining consistent results.

In terms of system integration, the System Monitoring Workstation development illustrated the benefits of having defined data sets and compatible data types. IBI defined a data set which was easy for both XYPOINT and Motorola to adapt to, partially because of the similar data formats driven by GPS code. These similar data sets allowed a large amount of data to be easily analyzed by the Evaluation Team.

8.3 INSTITUTIONAL ISSUES

The main challenges for Implementing Mayday services in the future will be institutional. Training, certification, communications protocols, and liability concerns will shape the future Mayday services. The technologies employed for Mayday services (DGPS, databases, computer mapping, and cellular communications) are all fairly well established. However, the transfer of pertinent information in a timely and consistent manner is more of a challenge. Standards for data and information handling in Mayday operations are currently being developed. Mayday systems of the future will need to adhere to these standards to ensure proper call handling.